concerning providing a layer containing ruthenium oxide and converting a portion of the ruthenium oxide layer to ruthenium to produce a ruthenium-containing layer having a rough surface as recited in claim 1. In addition, Fieberg is silent concerning any enhanced-surface-area electrically conductive structures. Therefore, claim 1 and dependent claims 2-5 are properly allowable over Fieberg.

Claim 14 recites a method of forming an enhanced-surface-area electrically conductive structure that includes providing a layer containing ruthenium oxide and converting the ruthenium oxide in the layer to ruthenium so as to produce a ruthenium-containing layer having a rough surface. As discussed above, Fieberg teaches a precipitate of ruthenium oxide and does not teach or suggest providing a ruthenium oxide layer, and claim 14 is properly allowable over Fieberg.

Claim 15 recites a method of forming an enhanced-surface-area electrically conductive structure that includes providing a layer containing ruthenium oxide, converting some ruthenium oxide in the layer to ruthenium so as to produce a ruthenium-containing layer having a rough surface, and exposing the layer having a rough surface to an ambient suitable to decrease the tendency of the layer to react with surrounding material. As previously discussed, Fieberg does not teach or suggest providing a layer of ruthenium oxide in such a structure. In addition, Fieberg is silent concerning exposing a ruthenium-containing layer to an ambient suitable to decrease the tendency of the ruthenium-containing layer to react with surrounding material. Fieberg describes separation of ruthenium from insoluble ruthenium dioxide but is silent concerning any exposure of a ruthenium-containing layer to an ambient suitable to decrease the tendency of the layer to react with surrounding material, or any other treatment of ruthenium after recovery. In addition, exposing recovered ruthenium to make it less reactive is contrary to Fieberg's objective of purifying ruthenium. See Fieberg, col. 1, lines 6-8. Thus, Fieberg teaches away from the method of claim 15. Accordingly, claim 15 and dependent claims 16-19 are properly allowable over Fieberg.

Claim 20 recites a method of forming an enhanced-surface-area electrically conductive structure that includes providing a layer containing ruthenium oxide and converting some ruthenium oxide in the layer to ruthenium by heating the layer in a reduced-pressure environment in a non-oxidizing ambient so as to produce a ruthenium-containing layer having a rough surface. Fieberg provides no teaching or suggestion of any electrically conductive structure or

providing a layer containing ruthenium oxide. As noted above, Fieberg teaches recovery of ruthenium from a precipitate of ruthenium oxide and is silent concerning such a treatment of ruthenium after recovery from the precipitate. Accordingly, claim 20 and dependent claims 21-29 are properly allowable over Fieberg.

Claim 30 recites a method of forming an enhanced-surface-area electrically conductive layer that includes providing a layer containing ruthenium oxide, selecting anneal conditions adapted to convert at least a portion of the ruthenium oxide to ruthenium, and annealing the layer so as to produce a layer having a rough surface. As discussed above, Fieberg does not teach or suggest providing a layer containing ruthenium oxide but instead teaches obtaining a ruthenium oxide precipitate. In addition, Fieberg is silent concerning selection of annealing conditions or annealing a ruthenium oxide containing layer to form a rough surface. Accordingly, claim 30 is properly allowable over Fieberg.

Claim 31 recites a method of forming a ruthenium-containing enhanced-surface-area electrically conductive layer that includes depositing a layer consisting essentially of ruthenium oxide onto a supporting structure and annealing the layer in reduced pressure environment in a non-oxidizing ambient so as to substantially convert the ruthenium oxide to ruthenium, leaving a roughened layer consisting essentially of ruthenium on the supporting structure. As discussed above, Fieberg does not teach or suggest depositing a layer of ruthenium oxide but instead teaches a ruthenium oxide precipitate. Accordingly, claim 31 is properly allowable over Fieberg.

Claim 59 recites a method of forming a passivated layer of ruthenium or ruthenium oxide during fabrication of an electronic device. The method includes providing a layer of ruthenium or ruthenium oxide, and annealing the layer in a nitrogen-supplying ambient or a nitrogen-supplying and reducing ambient so as to passivate the layer. Fieberg provides no teaching or suggestion of such method. Fieberg teaches methods for recovery of ruthenium from a ruthenium oxide precipitate and is silent concerning providing a layer of ruthenium oxide. In addition, Fieberg is silent concerning annealing so as to passivate a layer. Accordingly, claim 59 and dependent claims 60-63 are properly allowable over Fieberg.

Rejections under 35 U.S.C. § 103

Claims 6-13 and 32 stand rejected as allegedly obvious in view of Tsurumi, Japanese Patent 57-075653 ("Tsurumi"). This rejection is traversed. Claim 6 recites a method of forming

an enhanced-surface-area electrically conductive structure that includes providing a layer containing ruthenium oxide and converting at least a portion of the ruthenium oxide to ruthenium by heating the layer in a reduced-pressure environment with a pressure of about 75 torr or less so as to produce a layer having a rough surface. Tsurumi teaches a process for ruthenium recovery from an anti-corrosive substrate by reducing ruthenium oxide. Tsurumi is silent concerning an enhanced-surface-area electrically conductive structure, and provides no teaching, suggestion, or motivation for an enhanced-surface-area electrically conductive structure. In addition, as admitted by the Examiner, Tsurumi fails to teach heating a layer in a reduced pressure of about 75 torr or less to produce a layer having a rough surface. The Examiner contends that heating the layer in a reduced-pressure environment with a pressure of about 75 torr or less would have been an obvious design choice determinable by routine experimentation. However, Tsurumi does not teach or suggest any pressure ranges. In addition, routine experimentation according to the Tsurumi would be directed to improved extraction of ruthenium from an anti-corrosive substrate. Thus, Tsurumi fails to provide any suggestion or motivation for any method of producing an enhanced-surface-area electrically conductive structure and fails to provide any suggestion or motivation for heating a layer in a reduced pressure to produce a layer having a rough surface. Thus, the Examiner has not established a prima facie case of obviousness. Accordingly, independent claim 6 and dependent claims 7 and 8 are allowable over Tsurumi.

Claim 9 recites a method of forming an enhanced-surface-area electrically conductive structure that includes providing a layer containing ruthenium oxide, converting at least a portion of the ruthenium oxide to ruthenium by heating the layer to at least about 500°C in a reduced-pressure environment with a pressure of about 75 torr or less for a sufficient time so as to produce a layer having a rough surface. As previously discussed, Tsurumi teaches recovery of ruthenium from an anti-corrosive substrate and provides no teaching or suggestion concerning an enhanced-surface-area electrically conductive structure having a roughened surface. In addition, Tsurumi does not teach or suggest any pressure ranges suitable for production of such a structure. Therefore, claim 9 and dependent claims 10-13 are properly allowable over Tsurumi.

Claim 32 recites a method of forming an enhanced-surface-area electrically conductive layer that includes forming a layer of conducting material, forming a layer comprising ruthenium oxide on the layer of conducting material, and annealing the layer comprising ruthenium oxide so as to convert at least some of the ruthenium oxide to ruthenium so as to produce a layer

having a textured surface with a mean feature size of about 100 Angstroms or more. As discussed above, Tsurumi teaches recovery of ruthenium from an anti-corrosive substrate and provides no teaching, suggestion, or motivation for forming an enhanced-surface-area electrically conductive layer having a textured surface. Furthermore, Tsurumi does not teach any annealing step associated with forming a layer having a textured surface. Thus, Tsurumi does not teach or suggest the features of claim 32, and claim 32 is properly allowable over Tsurumi.

Claims 33-42, and 66-70 stand rejected as allegedly obvious from a combination of Zurcher, U.S. Patent 6,344,413 ("Zurcher") and Fieberg. This rejection is traversed. Claim 33 recites a method of forming an enhanced-surface-area electrically conductive layer that includes providing a layer comprising ruthenium oxide, annealing the layer comprising ruthenium oxide so as to convert at least some of the ruthenium oxide to ruthenium so as to produce a resulting layer having a textured surface with a mean feature size of about 100 Angstroms or more, and forming a layer of electrically conductive material conformally over the resulting layer such that the surface of the conductive material away from the resulting layer has a textured surface generally corresponding to that of the resulting layer. The Office action admits that Zurcher fails to teach conversion of some ruthenium oxide in a layer to ruthenium so as to produce a ruthenium containing layer having a rough surface, but alleges that formation of a rough surface would have been obvious. Office action, p. 5. Not only does Zurcher fail to disclose conversion of ruthenium oxide to ruthenium to produce a layer having a rough surface, Zurcher teaches away from producing a layer having a rough surface. Zurcher teaches "conformally deposited layers which are uniform over the entire first capacitor cavity." Zurcher, col. 2, lines 65-66 (emphasis added). Thus, Zurcher teaches uniform, conformal layers, not layers having a rough surface as recited in claim 33. Fieberg fails to remedy the deficiencies of Zurcher as Fieberg does not teach or suggest conversion of some ruthenium oxide in a layer to ruthenium so as to produce a ruthenium-containing layer having a rough surface. Accordingly, claim 33 is properly allowable over Zurcher and Fieberg, taken alone or in any combination.

Claim 34 recites a method of forming a capacitor that includes providing a layer containing ruthenium oxide, converting least some of the ruthenium oxide to ruthenium so as to produce a resulting layer having a rough surface, forming a layer of dielectric material over the resulting layer, and forming a layer of conductive material over the layer of dielectric material. As noted above, Zurcher does not teach or suggest formation of a rough surface, but rather

teaches away from formation of rough surfaces. Fieberg fails to remedy the defects of Zurcher. Fieberg teaches recovery of ruthenium from a ruthenium oxide precipitate, and does not teach providing any ruthenium oxide containing layers. Thus, Zurcher and Fieberg do not teach, suggest, or provide any motivation for the method recited in independent claim 34, and claim 34 and dependent claims35-40 are properly allowable over Zurcher and Fieberg taken alone or in any combination.

Claim 66 recites a method of forming an array of capacitors that includes providing a layer containing ruthenium oxide, converting at least some of the ruthenium oxide to ruthenium so as to produce a resulting layer having a rough surface, forming a layer of dielectric material over the resulting layer, forming a conductive layer on the layer of dielectric material, and defining an array of electrodes by patterning at least one of the ruthenium oxide layer or the resulting layer. As discussed above, neither Zurcher nor Fieberg teach or suggest producing a ruthenium-containing layer having a rough surface, and claim 66 and dependent claims 67-70 are properly allowable over Zurcher and Fieberg taken alone or in any combination.

In view of the above remarks, claims 1-42, 59-63, and 66-70 are in condition for allowance and action to such end requested.

Respectfully submitted,

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